

CLAIMS

1. An undulator characterized by comprising:
a first magnetic circuit for forming a periodic magnetic field;
a first support body for supporting the first magnetic circuit;
5 a second magnetic circuit arranged so as to be opposite to the
first magnetic circuit, for forming a periodic magnetic field;
a second support body for supporting the second magnetic
circuit;
a space formed between the oppositely arranged first and
10 second magnetic circuits, for passing an electron beam;
a vacuum chamber for in-vacuuming the first magnetic circuit
and the second magnetic circuit; and
a cooling mechanism for cooling a permanent magnet
constituting the first magnetic circuit and the second magnetic
15 circuit below the room temperature.

2. The undulator according to claim 1, further comprising:
an gap changing mechanism for changing an gap of the space;
a refrigerant passing tube provided in the cooling mechanism,
20 for passing a refrigerant; and
a connecting component for connecting the refrigerant
passing tube to each of the first support body and the second support
body, wherein
the connecting component has flexibility and allows the gap
25 changing mechanism to change the gap.

3. The undulator according to claim 1, wherein the cooling
mechanism comprises:
a first refrigerant passing tube provided to cool the first
30 magnetic circuit, for passing the refrigerant; and

a second refrigerant passing tube provided to cool the second magnetic circuit, for passing the refrigerant, wherein the first refrigerant passing tube is fixed to the first support body and the second refrigerant passing tube is fixed to the second support body.

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4. The undulator according to claim 1, wherein the cooling mechanism comprises:

a first refrigerant passing tube provided to cool the first magnetic circuit, for passing the refrigerant; and

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a second refrigerant passing tube provided to cool the second magnetic circuit, for passing the refrigerant, wherein the first refrigerant passing tube penetrates the inside of the first support body and the second refrigerant passing tube penetrates the inside of the second support body.

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5. The undulator according to claim 1, comprising:

an gap changing mechanism for changing an gap of the space;

a cooling head provided in the cooling mechanism and cooled by a freezing machine, and

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a connecting component for connecting the cooling head to each of the first support body and the second support body, wherein

the connecting component has flexibility and allows the gap changing mechanism to change the gap.

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6. The undulator according to any one of claims 1 to 5, wherein a hollow part is formed in each of a first support shaft for supporting the first support body and a second support shaft for supporting the second support body.

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7. The undulator according to any one of claims 1 to 6,

comprising:

a first temperature sensor for detecting a temperature of the first magnetic circuit;

a first heater for heating the first magnetic circuit;

5 **a second temperature sensor for detecting a temperature of the second magnetic circuit;**

a second heater for heating the second magnetic circuit; and

a temperature control unit for controlling the first heater and the second heater on the basis of temperature measured data

10 **provided by the first and second temperature sensors.**

8. The undulator according to any one of claims 1 to 7, characterized in that each of the first support body and the second support body has a holder for mounting the permanent magnet, and
15 **a holder support for supporting the holder, and**

a material of the holder has a thermal expansion coefficient greater than or equal to that of the holder support.